EXPERIMENT NO.1
ANALYSIS OF DISCRETE-TIME ODD AND EVEN SIGNALS
AND
DISCRETE-TIME PERIODIC AND NON-PERIODIC SIGNALS

OBJECTIVES:

- The purpose of this experiment is to familiarize the students with the basic commands in Scilab for signal generation and for plotting the generated signal
- To generate and plot an Odd and Even Discrete-Time Signals.
- To generate and plot a Periodic and Non-periodic Discrete-Time Signals

PROCEDURE A: DISCRETE-TIME EVEN SIGNAL

1. Encode the following command:

```
-->n=7:7;
-->x1=[0 0 0 1 2 3 4];
-->x=[x1,5,x1(length(x1):-1:1)];
-->a=gca();
-->a.thickness=2;
-->a.y_location="middle";
-->plot2d3(n,x);
-->xtitle('Graphical Representation of Discrete Time Even
                                    Signal','n','x[n]');
```

2. Observe and draw the figure generated. (You can use separate paper for your explanation and to show the result).

3. Re-type the command but this time change `x1=[0 0 0 1 2 3 4];` to `x1=[1 2 3 4 0 0 0];` and `x=[x1,5,x1(length(x1):-1:1)];` to `x=[x1,7,x1(length(x1):-1:1)];`. What is the result? (You can use separate paper for your explanation and to show the result).

4. Change the value of `a.thickness=2;` to `a.thickness=5;` and then remove the `a.y_location="middle";` command. Run again the program. What is the result? (You can use separate paper for your explanation and to show the result).

5. Change the `plot2d3(n,x);` to `plot(n,x);`. What is the result? (You can use separate paper for your explanation and to show the result).

6. Re-type again the command but change `x1=[0 0 0 1 2 3 4];` to `x1=[0 0 0 -1 -2 -3 -4];` and return the value of `x` to `x=[x1,5,x1(length(x1):-1:1)];`. Also, add the syntax `a.x_location="middle";` after `a.y_location="middle";`. What is the result? (You can use separate paper for your explanation and to show the result).

OBSERVATIONS:

1. What is the meaning and use of (a) in a.gca(); (b) a.thickness=2; and (c) plot2d3(n,x); commands?

PROCEDURE B: DISCRETE-TIME ODD SIGNAL

1. Type the following command and observe the result:

```
-->n=5:5;
-->x1=[0 1 2 3 4 5];
-->x=[-x1($:-1:2),x1];
-->a=gca();
-->a.thickness=2;
-->a.y_location="middle";
-->a.x_location="middle";
-->plot2d3(n,x);
-->xtitle('Graphical Representation of Discrete Time Odd
                                        Signal','n','x[n]');
```

2. Change `x=[-x1($:-1:2),x1];` to `x=[-x1(1:1:$),x1];` and then run again the program. What is the result? (You can use separate paper for your explanation and to show the result).
3. Set now the syntax `x=[-x1(1:1:$),x1];` into `x=[-x1(2:1:$),x1];` and then run again the program. Do not include the xtitle command this time. What is the result? (You can use separate paper for your explanation and to show the result).

OBSERVATIONS:

1. Is the signal generated still a discrete-time odd signal? Why?
2. Explain the use of the syntax `x=[-x1($:-1:2),x1];`.

4. Encode the following and observe the output.

```
-->n=5:5;
-->x1=[5 4 3 2 1 0];
-->x=[-x1(%s:-1:1),x1(2:1:%s)];
-->a=gca();
-->a.y_location="origin";
-->a.x_location="origin";
-->plot2d3(n,x);
```

OBSERVATIONS:

1. Is the signal generated still a discrete-time odd signal? Add the syntax and then observe the result. Is the signal generated still a discrete-time odd signal? Why?

PROCEDURE C: DISCRETE-TIME PERIODIC SIGNAL

1. Type the following command and observe the result:

```
-->t=1:1:50;
-->a=20*%pi*t;b=40*%pi*t;
-->x=sin(a) + cos(b);
-->subplot(2,1,1);
-->plot(t,x); //periodic continuous-time signal
```

```
-->xtitle('Graphical Representation of Periodic Continuous-Time
                                        Signal','t','x[t]');
-->n=t;
-->fs=50; //sampling frequency
-->c=a/fs;d=b/fs;
-->y=sin(c)+cos(d);
-->subplot(2,1,2);
-->plot2d3(n,y);// periodic discrete-time signal
-->xtitle('Graphical Representation of Periodic Discrete-Time
                                        Signal','n','y[n]');
```

2. Change the value of the sampling frequency to 30 and then run again the program. Observe the result.

3. Now change the value of `t=1:1:50;` to `t=1:2:100;` and return the value of sampling frequency to 50 then run again the program. Compare the result to the signal generated in procedure1. (You can use separate paper for your explanation and to show the result).

PROCEDURE D: DISCRETE-TIME NON-PERIODIC SIGNAL

1. Encode the following program and observe the result.

```
-->t=1:1:50;
-->a=sqrt(5)*%pi*t;b=3*t;
-->x=sin(a) + cos(b);
-->subplot(2,1,1);
-->plot(t,x); //periodic continuous-time signal
-->xtitle('Graphical      Representation      of      Non-Periodic
Continuous-Time
                                        Signal','t','x[t]');
-->n=t;
-->fs=50; //sampling frequency
-->c=a/fs;d=b/fs;
-->y=sin(c)+cos(d);
-->subplot(2,1,2);
-->plot2d3(n,y);// periodic discrete-time signal
-->xtitle('Graphical Representation of Non-Periodic Discrete-Time
                                        Signal','n','y[n]');
```

2. Change the value of `t=1:1:50;` to `t=1:1:500;`. Run again the program and observe the result. (You can use separate paper for your explanation and to show the result).

3. Now change the value of the sampling frequency to 100. Run again the program and observe the result. (You can use separate paper for your explanation and to show the result).

OBSERVATIONS:

1. Is the signal generated a discrete-time non-periodic signal? Why?

2. What is the effect of varying the sampling frequency of the given signal?

ANSWERS TO THE REPORT

1. What is the general formula that will describe the EVEN discrete-time function?
2. What is the general formula that will describe the ODD discrete-time function?
3. Compare a discrete-time periodic signal to a discrete-time non-periodic signal?
4. From procedure C and D, how do we convert a continuous-time signal into a discrete-time signal?

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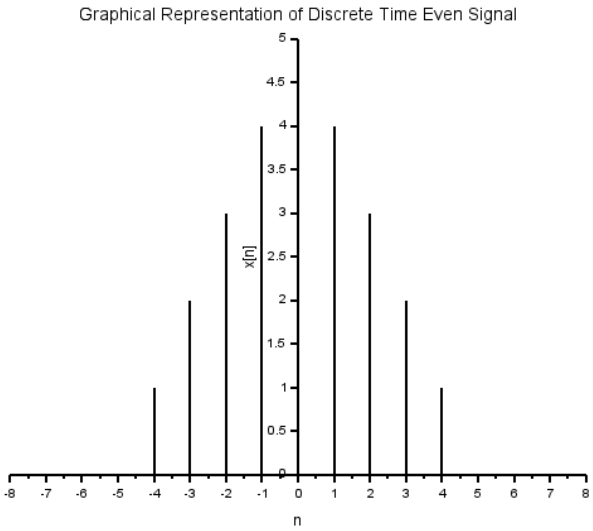
24/11/2022

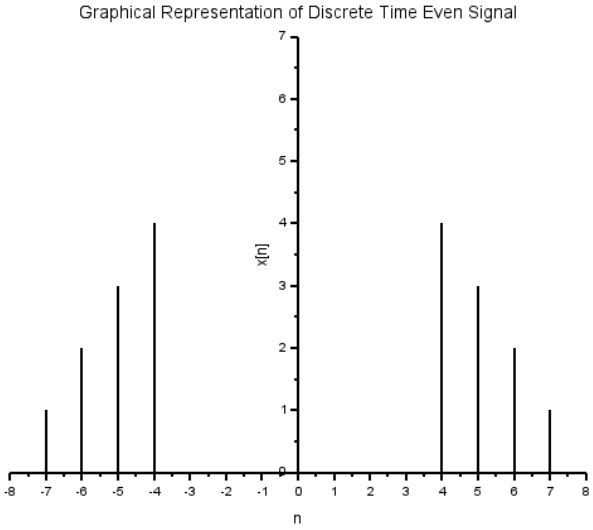
PROCEDURE A:

1.

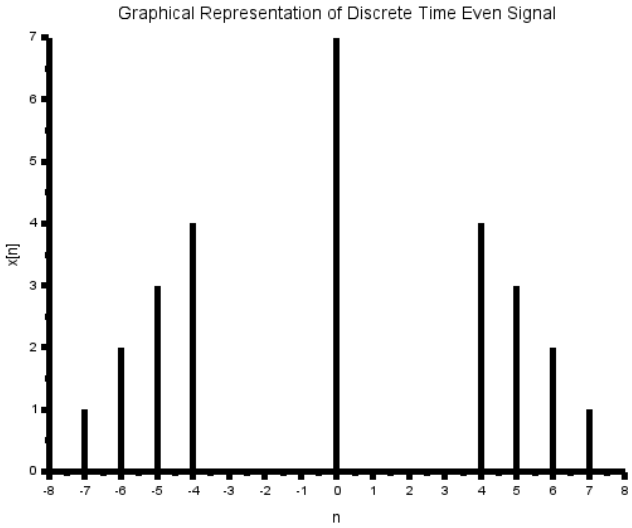
2.



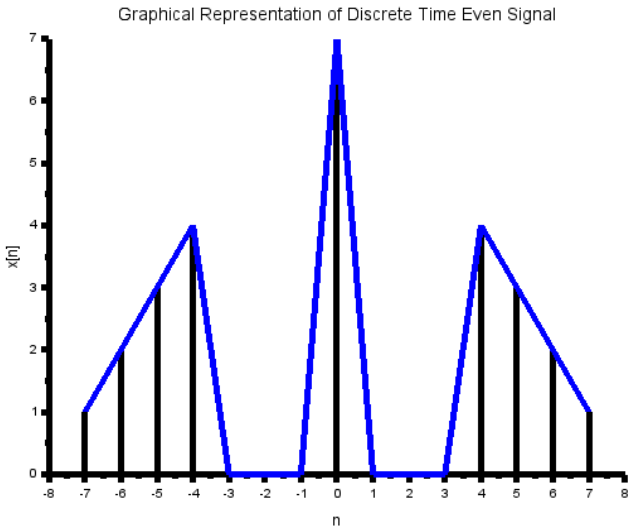
3.



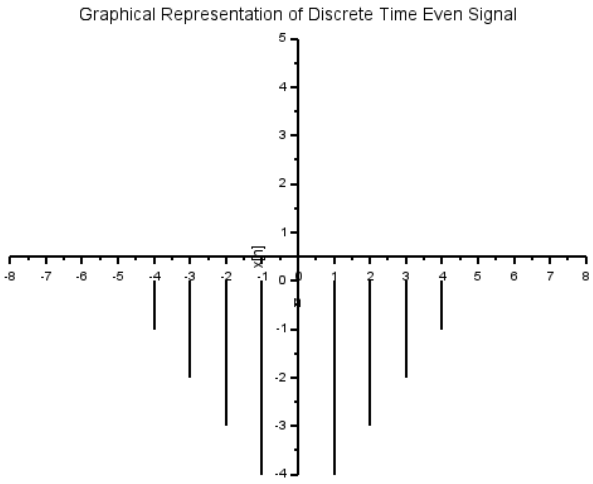
4.


Graphical Representation of Discrete Time Even Signal
x[n]
n

5.


Graphical Representation of Discrete Time Even Signal
x[n]
n

6.

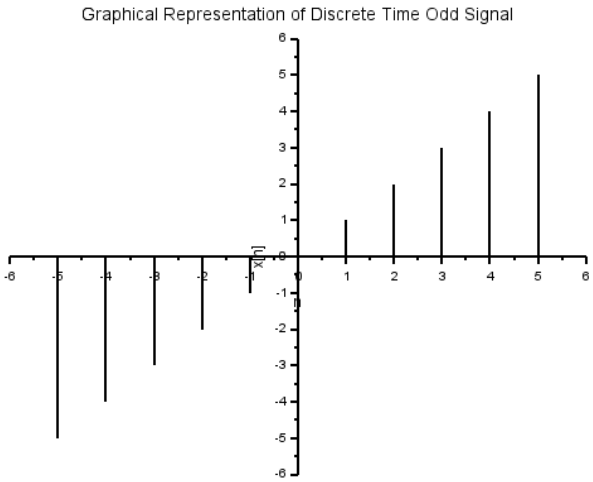

Graphical Representation of Discrete Time Even Signal
x[n]

OBSERVATION:

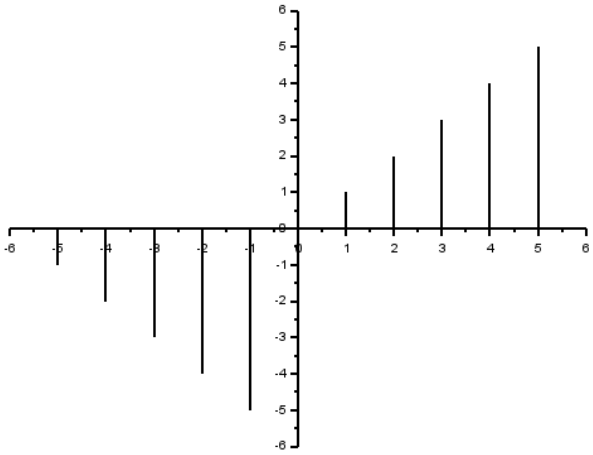
1. The first command returns the axes of the plot graphed. The second command sets the thickness of plots in the graph and the last command plots the values using vertical bars.

PROCEDURE B:

1.



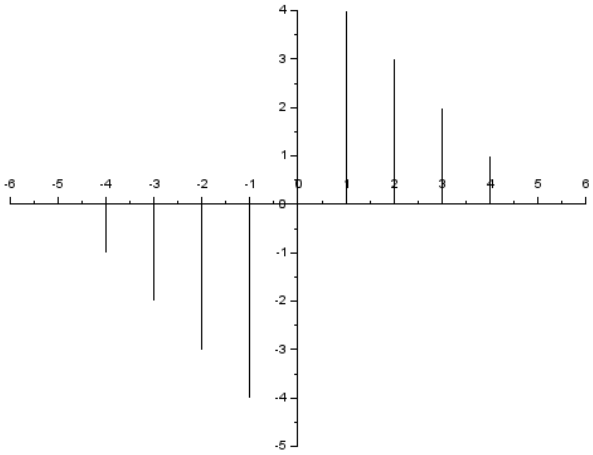
2. The program returns an error with incompatible input arguments.
3.



OBSERVATION:

1. It is not a discrete-time odd signal as the signal is not symmetric along the origin point of the signal.
2. The command slices a matrix with its values reversed to the original matrix.

4.

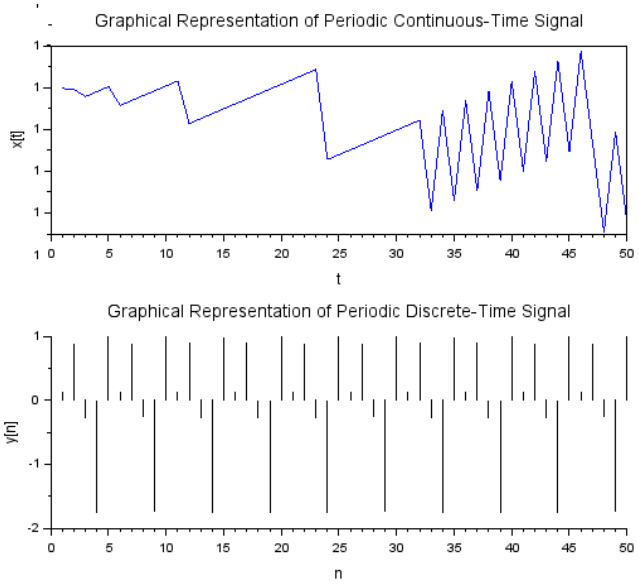


OBSERVATION:

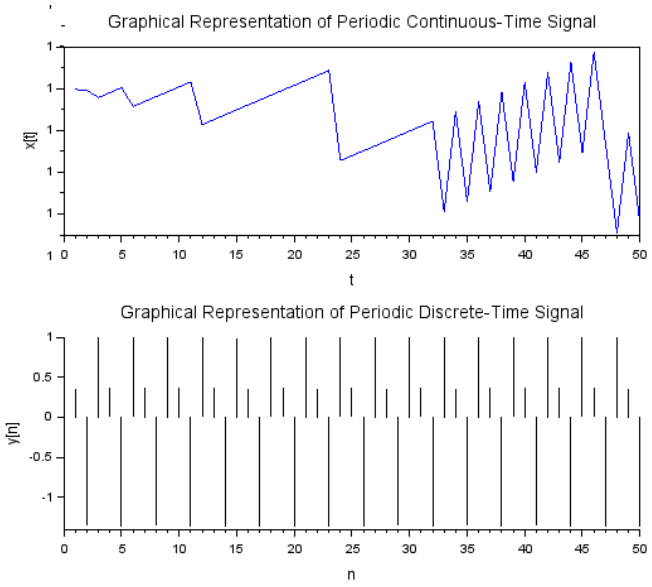
1. It is a discrete-time odd signal as it is symmetric to the origin point of the signal.

PROCEDURE C:

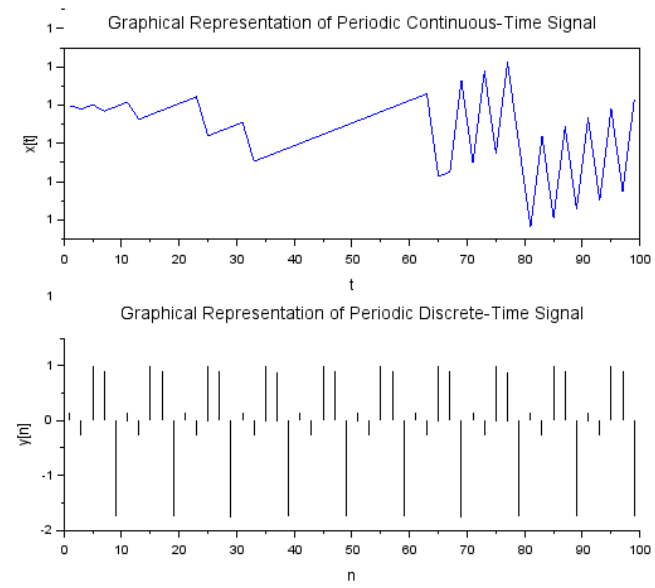
1.



2.



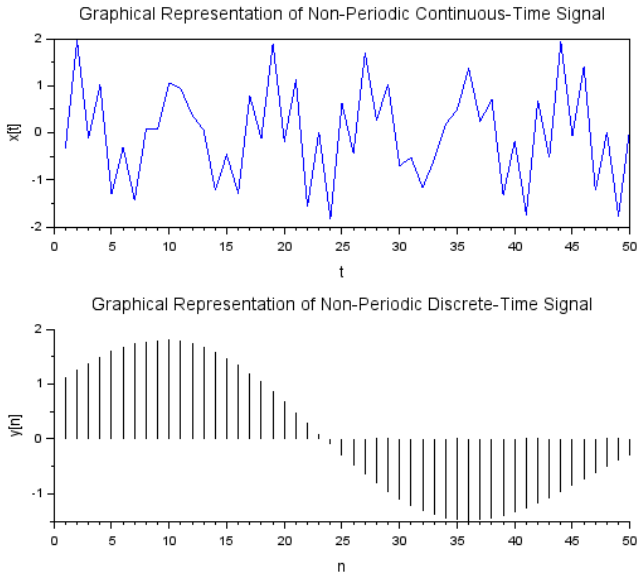
3.



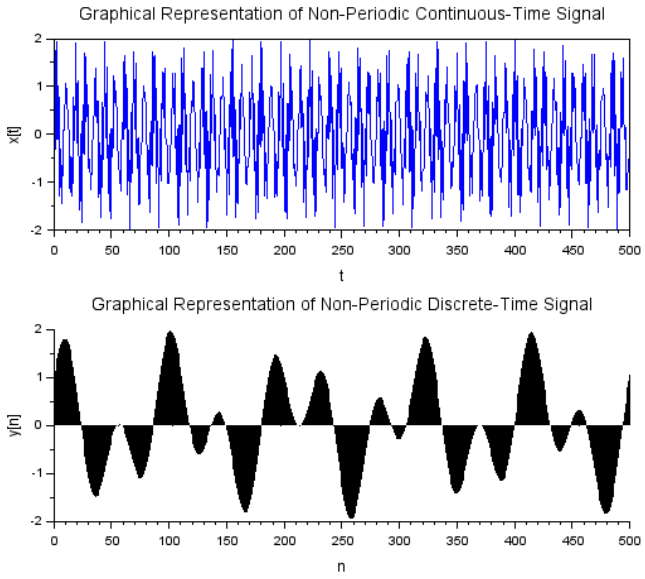
The signal generated is a lot different to the first signal as it lacked a peak within the middle of the signal and the later part is repeated more than the first waveform.

PROCEDURE D:

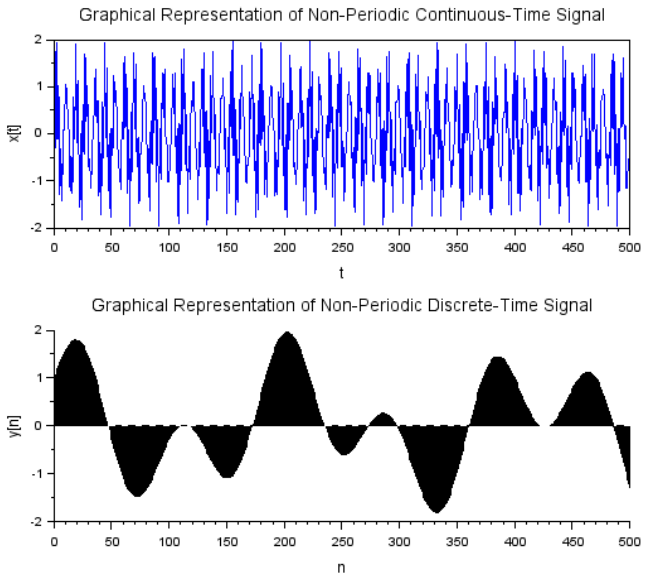
1.


Graphical Representation of Non-Periodic Continuous-Time Signal
x[t]
t
Graphical Representation of Non-Periodic Discrete-Time Signal
y[n]
n

2.


Graphical Representation of Non-Periodic Continuous-Time Signal
x[t]
t
Graphical Representation of Non-Periodic Discrete-Time Signal
y[n]
n

3.


Graphical Representation of Non-Periodic Continuous-Time Signal
x[t]
t
Graphical Representation of Non-Periodic Discrete-Time Signal
y[n]
n

OBSERVATION:

1. It is a non periodic discrete-time signal as the values are not repeating in each cycle and are not symmetric in time with each peak.
2. Varying the sampling frequency will cause in larger or smaller waveforms when graphed.

ANSWERS TO QUESTIONS:

1. Even discrete-time signals fulfill a condition where x(-t) = x(t), meaning that the value of the function with time t is the same if the time value is either positive or negative.
2. Odd discrete-time signals fulfill a condition where x(-t) = -x(t), meaning that the value of the function with time t is the opposite value if the time value is either positive or negative.
3. Periodic discrete time signals repeat their values within a specified time period. Non-periodic signals do not repeat their values within the same time period.
4. In order to convert a continuous time signal to its discrete time signal counterpart, we must divide the values of the signal functions to its sampling frequency and use the plot2d3 command to only graph its values in the vertical axis representation.